

1.6 Linear Coordinate Geometry Starter Questions

- 1) Find the distance between the points $A(1,3)$ and $B(6,15)$
- 2) Find the gradient between the points $A(-2,3)$ and $B(6,-3)$
- 3) Find the coordinates of the mid-point M of the straight-line joining $A(1, 3)$ and $B(5, 11)$

C1

Understand and use the equation of a straight line, including the forms $y - y_1 = m(x - x_1)$ and $ax + by + c = 0$; gradient conditions for two straight lines to be parallel or perpendicular.

Be able to use straight line models in a variety of contexts.

Assessed at AS and A-level

Teaching guidance

Students should:

- be able to solve problems using gradients, midpoints and the distance between two points, including the form $y = mx + c$ and the forms $y = a$ and $x = b$ for horizontal and vertical lines
- know that the product of the gradients of two perpendicular lines is -1
- Understand necessary and sufficient conditions for a quadrilateral to be a square, rectangle, rhombus, parallelogram, kite or trapezium and be able to apply understanding of straight lines to these.

C1

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Be able to use straight line models in a variety of contexts.

Notes

- In questions where the equation of a line is to be found, any correct form will be acceptable, unless specified in the question.
- However, trivial simplifications left undone in equations are likely to be penalised, eg

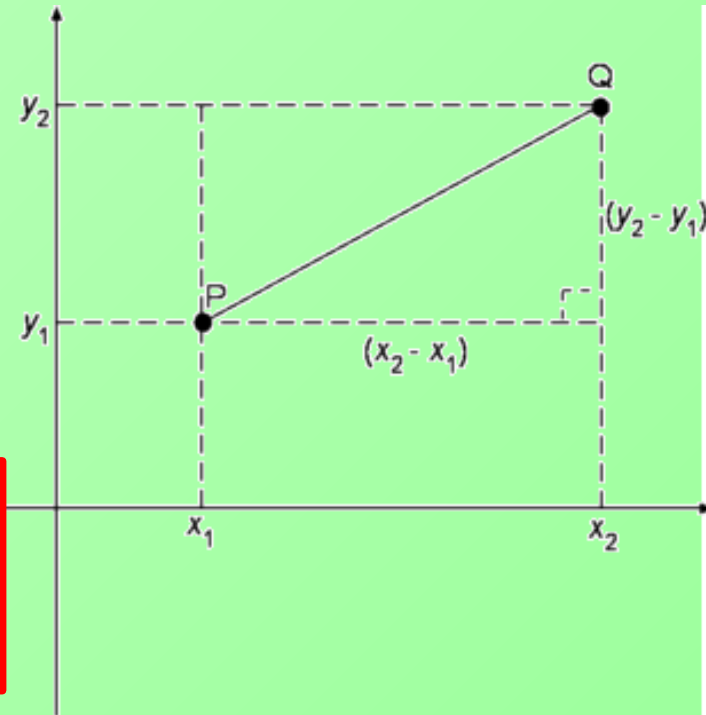
$$y - -2 = \frac{2}{4}(x - 1) \text{ should be simplified to } y + 2 = \frac{1}{2}(x - 1)$$

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General formula for the distance between two points

For two points $A(x_1, y_1)$ and $B(x_2, y_2)$, the distance AB can be found using the

$$\sqrt{(x_2 - x_1)^2 + (y_2 - y_1)^2}$$



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Example 1 - you do part (a)

The straight line l_1 with equation $4x - y = 0$ and the straight line l_2 with equation $2x + 3y - 21 = 0$ intersect at point A .

- a** Work out the coordinates of A .
- b** Work out the area of triangle AOB where B is the point where l_2 meets the x -axis.

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General formula for the mid-point of a line

For two points $A(x_1, y_1)$ and $B(x_2, y_2)$, the mid-point of AB can be found using the following formula:

$$\left(\frac{x_1 + x_2}{2}, \frac{y_1 + y_2}{2} \right)$$

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Example 2 - you do part (a)

(a) Find the midpoint of AB and CD .

(b) Points A and B lie on the line

. Find the midpoint of the line segment AB .

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General formula for the gradient of a straight line

The gradient, m , of the straight line
joining

$A(x_1, y_1)$ and $B(x_2, y_2)$ is

$$m = \frac{y_2 - y_1}{x_2 - x_1}$$

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Example 3 - you do part (a)

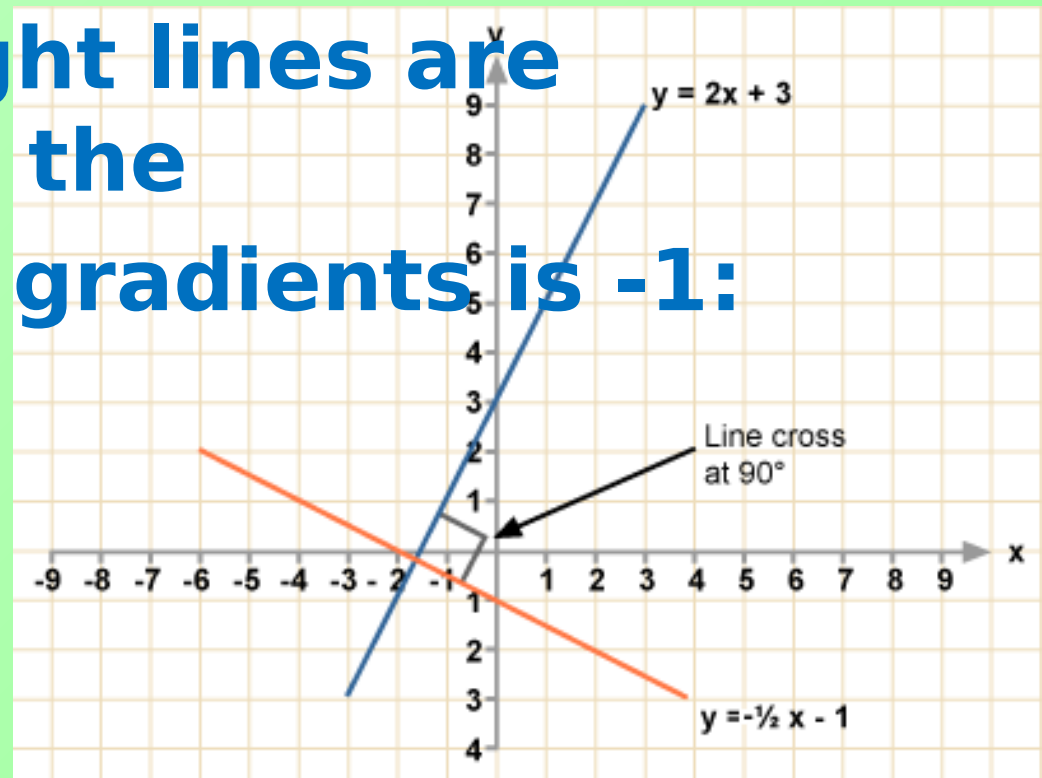
a) Work out the gradient of the line joining $(-2, 7)$ and $(4, 5)$

b) The line joining $(2, -5)$ to $(4, a)$ has gradient -1 . Work out the value of a .

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Parallel lines have the same gradient:

When two straight lines are perpendicular, the product of their gradients is **-1**:



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Example 4

A line is parallel to the line $6x + 3y - 2 = 0$ and it passes through the point $(0, 3)$.
Work out the equation of the line.

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Example 5

Work out whether these pairs of lines are parallel, perpendicular or neither:

a $3x - y - 2 = 0$
 $x + 3y - 6 = 0$

b $y = \frac{1}{2}x$
 $2x - y + 4 = 0$

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Example 6

A triangle has vertices $A(1, 2)$ and $B(4, 6)$

Show that the triangle ABC is a right-angled triangle.

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General formula for the equation of a straight line

$$y = mx + c$$

m is the gradient and
 c is the y -intercept

Alternative form

$$y - y_1 = m(x - x_1)$$

use this from now on!!

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Example 7 - you try these

Find the equation of the line with gradient 5 that passes through the point $(3, 2)$.

Find the equation of the line that passes through the points $(5, 7)$ and $(3, -1)$.

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Example 8

The line $y = 3x - 9$ meets the x -axis at the point A . Find the equation of the line with gradient $\frac{2}{3}$ that passes through point A . Write your answer in the form $ax + by + c = 0$, where a , b and c are integers.

The lines $y = 4x - 7$ and $2x + 3y - 21 = 0$ intersect at the point A . The point B has coordinates $(-2, 8)$. Find the equation of the line that passes through the points A and B . Write your answer in the form $ax + by + c = 0$, where a , b and c are integers.